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DATSKOVSKIY, SERGEY

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/697,727	GRAEPEL ET AL.	
	Examiner	Art Unit	
	Sergey Datskovskiy	2121	

-- *The MAILING DATE of this communication appears on the cover sheet with the correspondence address* --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *29 October 2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-73* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-9,12-31 and 34-73* is/are rejected.

7)☒ Claim(s) *10,11,32 and 33* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *29 October 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: _____.

DETAILED ACTION

1. Claims 1-73 have been submitted for examination.

2. Claims 1-9, 12-31, and 34-73 have been rejected.

3. Claims 10-11 and 32-33 have been objected.

Claim Objections

4. Claim 46 is objected to because of the following informalities: claim 46 contains a dot on line 2. Every claim can only be represented by a single sentence. Appropriate correction is required.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

5. Claims 1-9, 12-13, 16-20, 22-31, 34-35, 38-42, 44-54, and 56-73 are rejected under 35 U.S.C. 102(b) as being anticipated by Simard et al. ("Transformation Invariance in Pattern Recognition – Tangent Distance and Tangent Propagation").

Claim 1

Simard teaches a method comprising:

generating derivatives (page 4, lines 7-4 from the bottom; disclosed as tangent vectors or Lie derivatives) of a nonlinear invariance transformation (page 4, paragraph 2) at a training data point with respect to a transformation parameter (page 9, chapter 2.1, first paragraph), the training data point representing one of a plurality of training patterns (page 4, paragraph 4); and

generating a classifier representation based on the derivatives for classifying a test pattern in the presence of the nonlinear invariance transformation (page 18, chapter 3; generating a classifier is disclosed by incorporating invariance into a classification function).

Claim 2

Simard teaches the method of claim 1 further comprising: classifying the test pattern based on the classifier representation (page 1, chapter 1, lines 5-7).

Claim 3

Simard teaches the method of claim 1 further comprising: receiving the plurality of training patterns; and characterizing one of the training patterns to provide the training data point (page 18, last paragraph).

Claim 4

Simard teaches the method of claim 1 further comprising: classifying the test pattern based on the classifier representation to provide a classification signal (page 1,

chapter 1, lines 5-7; disclosed as classifying digit images); and inputting the test pattern to the operation of generating derivatives as a training pattern, responsive to the classifying operation (page 4, paragraph 4; disclosed by generating a tangent plane of a pattern).

Claim 5

Simard teaches the method of claim 1 further comprising: classifying the test pattern based on the classifier representation to provide a classification signal (page 1, chapter 1, lines 5-7; disclosed as classifying digit images); inputting the test pattern to the operation of generating derivatives as a training pattern (page 4, paragraph 4; disclosed by generating a tangent plane of a pattern); and inputting the classification signal to the operation of generating derivatives in association with the test pattern (page 20, last paragraph before chapter 3.1; disclosed by the tangent propagation algorithm analogous to backpropagation; see also page 22, lines 4-6).

Claim 6

Simard teaches the method of claim 1 wherein the non-linear invariant transformation is represented by a Taylor expansion polynomial (page 4, equation (2)).

Claim 7

Simard teaches the method of claim 1 wherein the nonlinear invariance transformation models a rotation of an individual training pattern (page 29, Rotation).

Claim 8

Simard teaches the method of claim 1 wherein the nonlinear invariance transformation models a sheering in an individual training pattern (page 13, paragraph 2, lines 5-8; sheering is included in hyperbolic transformations).

Claim 9

Simard teaches the method of claim 1 wherein the nonlinear invariance transformation models a translation in an individual training pattern (page 29, X-translation and Y-translation).

Claim 12

Simard teaches the method of claim 1 wherein the nonlinear invariance transformation models a scaling of an individual training pattern (page 30, Scaling).

Claim 13

Simard teaches the method of claim 1 wherein the nonlinear invariance transformation models a change in line thickness in an individual training pattern (page 30, Thickening).

Claim 16

Simard teaches the method of claim 1 wherein the test pattern includes an image (page 1, Introduction, lines 5-7).

Claim 17

Simard teaches the method of claim 1 wherein the test pattern includes an audio input (page 5, paragraph 2, speech).

Claim 18

Simard teaches the method of claim 1 wherein the test pattern includes a handwriting pattern (page 1, Introduction, lines 5-7).

Claim 19

Simard teaches the method of claim 1 wherein the test pattern includes a time series (page 5, paragraph 2, temporal signals).

Claim 20

Simard teaches the method of claim 1 further comprising: restricting a range of the transformation parameter to a closed interval on a line of real numbers (considering the fact that the parameters define the transformation values such as translation, scaling and rotation, it is inherent for these parameters to belong to a limited range of values).

Claim 22

Simard teaches the method of claim 1 wherein the operation of generating derivatives comprises: generating derivatives of the nonlinear invariance transformation at the training data point with respect to a plurality of transformation parameters (page 9, chapter 2.1, first paragraph; disclosed by having a vector of parameters).

Claim 23

Simard teaches a computer program product encoding a computer program for executing on a computer system a computer process, the computer process comprising:

generating derivatives (page 4, lines 7-4 from the bottom; disclosed as tangent vectors or Lie derivatives) of a nonlinear invariance transformation (page 4, paragraph 2) at a training data point with respect to a transformation parameter (page 9, chapter 2.1, first paragraph), the training data point representing one of a plurality of training patterns (page 4, paragraph 4); and

generating a classifier representation based on the derivatives for classifying a test pattern in the presence of the nonlinear invariance transformation (page 18, chapter 3; generating a classifier is disclosed by incorporating invariance into a classification function).

Claim 24

Simard teaches the computer program product of claim 23 wherein the computer process further comprises: classifying the test pattern based on the classifier representation (page 1, chapter 1, lines 5-7).

Claim 25

Simard teaches the computer program product of claim 23 wherein the computer process further comprises: receiving the plurality of training patterns; and characterizing one of the training patterns to provide the training data point (page 18, last paragraph).

Claim 26

Simard teaches the computer program product of claim 23 wherein the computer process further comprises: classifying the test pattern based on the classifier representation (page 1, chapter 1, lines 5-7; disclosed as classifying digit images); and inputting the test pattern to the operation of generating derivatives as a training pattern, responsive to the classifying operation (page 4, paragraph 4; disclosed by generating a tangent plane of a pattern).

Claim 27

Simard teaches the computer program product of claim 23 wherein the computer process further comprises: classifying the test pattern based on the classifier representation to provide a classification signal (page 1, chapter 1, lines 5-7; disclosed as classifying digit images); inputting the test pattern to the operation of generating

derivatives as a training pattern (page 4, paragraph 4; disclosed by generating a tangent plane of a pattern); and inputting the classification signal to the operation of generating derivatives in association with the test pattern (page 20, last paragraph before chapter 3.1; disclosed by the tangent propagation algorithm analogous to backpropagation; see also page 22, lines 4-6).

Claim 28

Simard teaches the computer program product of claim 23 wherein the non-linear invariant transformation is represented by a Taylor expansion polynomial (page 4, equation (2)).

Claim 29

Simard teaches the computer program product of claim 23 wherein the nonlinear invariance transformation models a rotation of an individual training pattern (page 29, Rotation).

Claim 30

Simard teaches the computer program product of claim 23 wherein the nonlinear invariance transformation models a sheering in an individual training pattern (page 13, paragraph 2, lines 5-8; sheering is included in hyperbolic transformations).

Claim 31

Simard teaches the computer program product of claim 23 wherein the nonlinear invariance transformation models a translation in an individual training pattern (page 29, X-translation and Y-translation).

Claim 34

Simard teaches the computer program product of claim 23 wherein the nonlinear invariance transformation models a scaling of an individual training pattern (page 30, Scaling).

Claim 35

Simard teaches the computer program product of claim 23 wherein the nonlinear invariance transformation models a change in line thickness in an individual training pattern (page 30, Thickening).

Claim 38

Simard teaches the computer program product of claim 23 wherein the test pattern includes an image (page 1, Introduction, lines 5-7).

Claim 39

Simard teaches the computer program product of claim 23 wherein the test pattern includes an audio input (page 5, paragraph 2, speech).

Claim 40

Simard teaches the computer program product of claim 23 wherein the test pattern includes a handwriting pattern (page 1, Introduction, lines 5-7).

Claim 41

Simard teaches the computer program product of claim 23 wherein the test pattern includes a time series (page 5, paragraph 2, temporal signals).

Claim 42

Simard teaches the computer program product of claim 23 wherein the computer process further comprises: restricting a range of the transformation parameter to a closed interval on a line of real numbers (considering the fact that the parameters define the transformation values such as translation, scaling and rotation, it is inherent for these parameters to belong to a limited range of values).

Claim 44

Simard teaches the computer program product of claim 23 wherein the operation of generating derivatives comprises: generating derivatives of the nonlinear invariance transformation at the training data point with respect to a plurality of transformation parameters (page 9, chapter 2.1, first paragraph; disclosed by having a vector of parameters).

Claim 45

Simard teaches a system comprising:

a derivative generator generating derivatives (page 4, lines 7-4 from the bottom; disclosed as tangent vectors or Lie derivatives) of a nonlinear invariance transformation (page 4, paragraph 2) at a training data point with respect to a transformation parameter (page 9, chapter 2.1, first paragraph), the training data point representing one of a plurality of training patterns (page 4, paragraph 4); and

a classifier representation generator generating a classifier representation based on the derivatives for classifying a test pattern in the presence of the nonlinear invariance transformation (page 18, chapter 3; generating a classifier is disclosed by incorporating invariance into a classification function).

Claim 46

Simard teaches the system of claim 45 further comprising: a classifier classifying the test pattern based on the classifier representation (page 1, chapter 1, lines 5-7; disclosed as classifying digit images) a training data characterizer receiving the plurality of training patterns and characterizing one of the training patterns to provide the training data point (page 4, paragraph 4; disclosed by generating a tangent plane of a pattern).

Claim 47

Simard teaches the system of claim 45 wherein the derivative generator inputs the test pattern as a training pattern (page 18, last paragraph).

Claim 48

Simard teaches the system of claim 45 further comprising: a classifier classifying the test pattern based on the classifier representation to provide a classification signal (page 1, chapter 1, lines 5-7; disclosed as classifying digit images), wherein the derivative generator inputs the test pattern as a training pattern and inputs the classification signal in association with the test pattern (page 4, paragraph 4; disclosed by generating a tangent plane of a pattern).

Claim 49

Simard teaches the system of claim 45 wherein the non-linear invariant transformation is represented by a Taylor expansion polynomial (page 4, equation (2)).

Claim 50

Simard teaches the system of claim 45 wherein the test pattern includes an image (page 1, Introduction, lines 5-7).

Claim 51

Simard teaches the system of claim 45 wherein the test pattern includes an audio input (page 5, paragraph 2, speech).

Claim 52

Simard teaches the system of claim 45 wherein the test pattern includes a handwriting pattern (page 1, Introduction, lines 5-7).

Claim 53

Simard teaches the system of claim 45 wherein the test pattern includes a time series (page 5, paragraph 2, temporal signals).

Claim 54

Simard teaches the system of claim 45 wherein a range of the transformation parameter is restricted to a closed interval on a line of real numbers (considering the fact that the parameters define the transformation values such as translation, scaling and rotation, it is inherent for these parameters to belong to a limited range of values).

Claim 56

Simard teaches the system of claim 45 wherein the classifier representation generator generates derivatives of the nonlinear invariance transformation at the training data point with respect to a plurality of transformation parameters (page 9, chapter 2.1, first paragraph; disclosed by having a vector of parameters).

Claim 57

Simard teaches a method comprising: characterizing a plurality of training patterns, each training pattern corresponding to a training data point in a feature space (page 32, last paragraph); determining a classification for each training pattern (page 1, chapter 1, lines 5-7); generating derivatives (page 4, lines 7-4 from the bottom; disclosed as tangent vectors or Lie derivatives) of a nonlinear invariance transformation (page 4, paragraph 2) at individual training data points with respect to a transformation parameter (page 9, chapter 2.1, first paragraph); and generating an optimized weight vector, based on the derivatives and the classification of each training pattern, for classifying a test pattern in the presence of the nonlinear invariance transformation (page 18, last paragraph through page 19, first paragraph; generating vector *w* which minimizes the energy function).

Claim 58

Simard teaches the method of claim 57 further comprising: classifying the test pattern based on the optimized weight vector (page 1, chapter 1, lines 5-7; classifying is based on the vector since the invariance is incorporated directly into a classification function, see page 18, chapter 3, paragraph 1).

Claim 59

Simard teaches the method of claim 57 further comprising: classifying the test pattern based on the optimized weight vector to provide a classification signal (page 1, chapter 1, lines 5-7; disclosed as classifying digit images; classifying is based on the

vector since the invariance is incorporated directly into a classification function, see page 18, chapter 3, paragraph 1); and inputting the test pattern to the operation of generating derivatives as a training pattern, responsive to the classifying operation (page 4, paragraph 4; disclosed by generating a tangent plane of a pattern).

Claim 60

Simard teaches the method of claim 57 further comprising: classifying the test pattern based on the optimized weight vector to provide a classification signal (page 1, chapter 1, lines 5-7; disclosed as classifying digit images; classifying is based on the vector since the invariance is incorporated directly into a classification function, see page 18, chapter 3, paragraph 1); inputting the test pattern to the operation of generating derivatives as a training pattern (page 4, paragraph 4; disclosed by generating a tangent plane of a pattern); and inputting the classification signal to the operation of generating derivatives in association with the test pattern (page 20, last paragraph before chapter 3.1; disclosed by the tangent propagation algorithm analogous to backpropagation; see also page 22, lines 4-6).

Claim 61

Simard teaches the method of claim 57 wherein the non-linear invariant transformation is represented by a Taylor expansion polynomial (page 4, equation (2)).

Claim 62

Simard teaches a computer program product encoding a computer program for executing on a computer system a computer process, the computer process comprising: characterizing a plurality of training patterns, each training pattern corresponding to a training data point in a feature space (page 32, last paragraph); determining a classification for each training pattern (page 1, chapter 1, lines 5-7); generating derivatives (page 4, lines 7-4 from the bottom; disclosed as tangent vectors or Lie derivatives) of a nonlinear invariance transformation (page 4, paragraph 2) at individual training data points with respect to a transformation parameter (page 9, chapter 2.1, first paragraph); and generating an optimized weight vector, based on the derivatives and the classification of each training pattern, for classifying a test pattern in the presence of the nonlinear invariance transformation (page 18, last paragraph through page 19, first paragraph; generating vector *w* which minimizes the energy function).

Claim 63

Simard teaches the computer program product of claim 62 wherein the computer process further comprises: classifying the test pattern based on the optimized weight vector (page 1, chapter 1, lines 5-7; classifying is based on the vector since the invariance is incorporated directly into a classification function, see page 18, chapter 3, paragraph 1).

Claim 64

Simard teaches the computer program product of claim 62 wherein the computer process further comprises: characterizing one of the training patterns to provide the training data point (page 18, last paragraph).

Claim 65

Simard teaches the computer program product of claim 62 wherein the computer process further comprises: classifying the test pattern based on the optimized weight vector (page 1, chapter 1, lines 5-7; disclosed as classifying digit images; classifying is based on the vector since the invariance is incorporated directly into a classification function, see page 18, chapter 3, paragraph 1); and inputting the test pattern to the operation of generating derivatives as a training pattern, responsive to the classifying operation (page 4, paragraph 4; disclosed by generating a tangent plane of a pattern).

Claim 66

Simard teaches the computer program product of claim 62 wherein the computer process further comprises: classifying the test pattern based on the optimized weight vector to provide a classification signal (page 1, chapter 1, lines 5-7; disclosed as classifying digit images; classifying is based on the vector since the invariance is incorporated directly into a classification function, see page 18, chapter 3, paragraph 1); inputting the test pattern to the operation of generating derivatives as a training pattern (page 4, paragraph 4; disclosed by generating a tangent plane of a pattern); and inputting the classification signal to the operation of generating derivatives in

association with the test pattern (page 20, last paragraph before chapter 3.1; disclosed by the tangent propagation algorithm analogous to backpropagation; see also page 22, lines 4-6).

Claim 67

Simard teaches the computer program product of claim 62 wherein the non-linear invariant transformation is represented by a Taylor expansion polynomial (page 4, equation (2)).

Claim 68

Simard teaches a system comprising: a training data characterizer characterizing a plurality of training patterns, each training pattern corresponding to a training data point in a feature space (page 32, last paragraph) and determining a classification for each training pattern (page 1, chapter 1, lines 5-7); a derivative generator generating derivatives (page 4, lines 7-4 from the bottom; disclosed as tangent vectors or Lie derivatives) of a nonlinear invariance transformation (page 4, paragraph 2) at individual training data points with respect to a transformation parameter (page 9, chapter 2.1, first paragraph); and a classifier representation generator generating an optimized weight vector, based on the derivatives and the classification of each training pattern, for classifying a test pattern in the presence of the nonlinear invariance transformation (page 18, last paragraph through page 19, first paragraph; generating vector *w* which minimizes the energy function).

Claim 69

Simard teaches the system of claim 68 further comprising: a classifier classifying the test pattern based on the classifier representation (page 1, chapter 1, lines 5-7).

Claim 70

Simard teaches the system of claim 68 further comprising: a training data characterizer receiving the plurality of training patterns and characterizing one of the training patterns to provide the training data point (page 18, last paragraph).

Claim 71

Simard teaches the system of claim 68 wherein the derivative generator inputs the test pattern as a training pattern (page 4, paragraph 4; disclosed by generating a tangent plane of a pattern).

Claim 72

Simard teaches the system of claim 68 further comprising: a classifier classifying the test pattern based on the classifier representation to provide a classification signal (page 1, chapter 1, lines 5-7; disclosed as classifying digit images), wherein the derivative generator inputs the test pattern as a training pattern and inputs the classification signal in association with the test pattern (page 4, paragraph 4; disclosed by generating a tangent plane of a pattern).

Claim 73

Simard teaches the system of claim 68 wherein the non-linear invariant transformation is represented by a Taylor expansion polynomial (page 4, equation (2)).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. Claims 14-15 and 36-37 are rejected under 35 U.S.C. 103(a) as being unpatentable over Simard et al. ("Transformation Invariance in Pattern Recognition – Tangent Distance and Tangent Propagation") in view of Williams et al. (US Patent No. 6,178,261).

Claim 14

Simard teaches the method of claim 1.

Simard does not expressly teach that the nonlinear invariance transformation models a change in frequency composition of an individual training pattern.

Williams teaches extending the methodology of character recognition to time-frequency representations of signals by treating the signals as images (col. 10, lines 45-

50; changes in duration and frequency corresponds to image transformation, such as scaling).

Simard and Williams are analogous art since they are both related to pattern recognition. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to include the invariance transformation used for character recognition from Simard and combine it with time-frequency representation from Williams. Simard disclosed the possibility of using his algorithm for speech recognition (page 5, paragraph 1). However, Simard also mentions that it is not clear to what transformation the classification is invariant (page 33, first whole paragraph). Therefore, it would be useful to combine the inventions of Simard and Williams to provide the invariant transformations for speech recognition. Therefore, it would have been obvious to modify Simard in view of Williams by treating time-frequency signals as images and applying scaling and translation transformations corresponding to changes in frequency and duration.

Claim 15

Simard teaches the method of claim 1.

Simard does not expressly teach that the nonlinear invariance transformation models a change in duration of an individual training pattern.

Williams teaches extending the methodology of character recognition to time-frequency representations of signals by treating the signals as images (col. 10, lines 45-

50; changes in duration and frequency corresponds to image transformation, such as scaling).

At the time of the invention, it would have been obvious to a person of ordinary skill in the art to include the invariance transformation used for character recognition from Simard and combine it with time-frequency representation from Williams using the same motivation as in claim 14 above.

Claim 36

Simard teaches the computer program product of claim 23.

Simard does not expressly teach that the nonlinear invariance transformation models a change in frequency composition of an individual training pattern.

Williams teaches extending the methodology of character recognition to time-frequency representations of signals by treating the signals as images (col. 10, lines 45-50; changes in duration and frequency corresponds to image transformation, such as scaling).

At the time of the invention, it would have been obvious to a person of ordinary skill in the art to include the invariance transformation used for character recognition from Simard and combine it with time-frequency representation from Williams using the same motivation as in claim 14 above.

Claim 37

Simard teaches the computer program product of claim 23.

Simard does not expressly teach that the nonlinear invariance transformation models a change in duration of an individual training pattern.

Williams teaches extending the methodology of character recognition to time-frequency representations of signals by treating the signals as images (col. 10, lines 45-50; changes in duration and frequency corresponds to image transformation, such as scaling).

At the time of the invention, it would have been obvious to a person of ordinary skill in the art to include the invariance transformation used for character recognition from Simard and combine it with time-frequency representation from Williams using the same motivation as in claim 14 above.

7. Claims 21, 43 and 55 are rejected under 35 U.S.C. 103(a) as being unpatentable over Simard et al. ("Transformation Invariance in Pattern Recognition – Tangent Distance and Tangent Propagation") in view of Haasdonk ("Tangent Distance Kernels for Support Vector Machines").

Claim 21

Simard teaches the method of claim 1.

Simard does not expressly teach representing a scalar product of the classifier representation with the derivatives of the nonlinear invariance transformation at the training data point with respect to the transformation parameter by a nonlinear positive definite real-valued kernel function.

Haasdonk teaches representing a scalar product of the classifier representation (page 866, chapter 4, first paragraph) with the derivatives of the nonlinear invariance transformation at the training data point with respect to the transformation parameter (page 865, chapter 2, Tangent distance, which comes from the concept introduced by Simard) by a nonlinear positive definite real-valued kernel function (page 866, left column, last paragraph – right column first paragraph).

Simard and Haasdonk are analogous art since they are both directed to classification using invariant transformation and tangent distance. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to include the kernel function from Haasdonk and combine it with invariant transformation using derivatives from Simard. The reason for doing so would be to improve the classification performance (Haasdonk, page 867, left column, last paragraph). Therefore, it would have been obvious to modify Simard in view of Haasdonk by combining kernel function with tangent information.

Claim 43

Simard teaches the computer program product of claim 23.

Simard does not expressly teach representing a scalar product of the classifier representation with the derivatives of the nonlinear invariance transformation at the training data point with respect to the transformation parameter by a nonlinear positive definite real-valued kernel function.

Haasdonk teaches representing a scalar product of the classifier representation (page 866, chapter 4, first paragraph) with the derivatives of the nonlinear invariance transformation at the training data point with respect to the transformation parameter (page 865, chapter 2, Tangent distance, which comes from the concept introduced by Simard) by a nonlinear positive definite real-valued kernel function (page 866, left column, last paragraph – right column first paragraph).

At the time of the invention, it would have been obvious to a person of ordinary skill in the art to include the kernel function from Haasdonk and combine it with invariant transformation using derivatives from Simard using the same motivation as in claim 21 above.

Claim 55

Simard teaches the system of claim 45.

Simard does not expressly teach wherein a nonlinear positive definite real-valued kernel function represents a scalar product of the classifier representation with the derivatives of the nonlinear invariance transformation at the training data point with respect to the transformation parameter.

Haasdonk teaches representing a scalar product of the classifier representation (page 866, chapter 4, first paragraph) with the derivatives of the nonlinear invariance transformation at the training data point with respect to the transformation parameter (page 865, chapter 2, Tangent distance, which comes from the concept introduced by

Simard) by a nonlinear positive definite real-valued kernel function (page 866, left column, last paragraph – right column first paragraph).

At the time of the invention, it would have been obvious to a person of ordinary skill in the art to include the kernel function from Haasdonk and combine it with invariant transformation using derivatives from Simard using the same motivation as in claim 21 above.

Allowable Subject Matter

8. Claims 10-11 and 32-33 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is a statement of reasons for the indication of allowable subject matter: the prior art of record taken alone or in combination fails to teach the nonlinear invariance transformation modeling a change in lighting angle from claims 10 and 32, or modeling a change in brightness from claims 11 and 33. Specifically, since the closest prior art of Simard et al. is directed to character recognition, there would be no obvious reason to use changes in brightness and lighting angle as nonlinear invariance transformations.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Simard (US Patent No. 5,422,961) teaches apparatus and

method for improving recognition of patterns by prototype transformation. Denker et al. (US Patent No. 5,572,628) teaches using invariant transformations for pattern recognition. Brown et al. (US Patent No. 5,768,420) teaches method and apparatus for handwriting recognition using invariant features. Bartlett et al. (US App. No. 2005/0071300) teaches kernels and methods for selecting kernels for use in learning machines. Zhang et al. (US Patent No. 6,996,549) teaches computer-aided image analysis. Scholkopf et al. teaches "Incorporating invariances in support vector learning machines". Chapelle teaches "Incorporating invariances in nonlinear support vector machines".

Contact Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Sergey Datskovskiy whose telephone number is (571) 272-8188. The examiner can normally be reached on Monday-Friday from 8:30am to 5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Anthony Knight, can be reached on (571) 272-3687. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only.

For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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